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# CHINA REPORT

## SCIENCE AND TECHNOLOGY

No. 130

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Chinese Academy of Sciences; Yin Weiping [3009 1983 5493],  
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CSO: 4008/465



## Armaments

AUTHOR: Bai Kunpu

ORG: None

TITLE: "The Imaging Properties of Visual Telescopic System"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 3, Aug 81  
pp 11-18

TEXT OF ENGLISH ABSTRACT: This paper presents the imaging property representation of monochromatic light and polychromatic light of the visual telescopic system based on the general equation of polychromatic OTF, taking the product of  $D_{\lambda}$ , light source distribution and standard relative visibility factor as a weighted function. By correcting the spectra of equipment (light source and receptor) of the MTF measurement, we have directly measured the polychromatic MTF of axial image point. In addition, referring to a variety of the proximate equations, this paper proposes that the polychromatic MTF can also be reduced to the calculating equation  $1/3(T_{500.0} + 2T_{589.3})$ , where  $T_{500.0}$  and  $T_{589.3}$  represent the MTF of wave lengths of 500.0 mμ and 589.3 mμ respectively. After having compared the results of both methods mentioned above with the exact calculated results, we conclude that both methods are reliable and convenient. As for off-axial image point, the measurement of the lateral chromatic aberration of half visual field is commended. Measuring method, parameter processing and some examples are briefly presented in this paper.

AUTHOR: WAN Yaoqing

ORG: None

TITLE: "The Development and Application of the Mechanical Optimal Design"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 3, Aug 81  
pp 52-59

TEXT OF ENGLISH ABSTRACT: The further research of the optimal calculating methods and wide application of the electronic computer provide the engineering designs with effective strong mathematical and computation instruments, which bring about a great change in the product design method. Mechanical products with optimal design have been increasing day by day for more than 20 years, especially in the 1970's. The development of the engineering design method, the reason for the optimal design development and the application of the optimal computation method in the mechanical industry are summarized in this paper, and the urgent assignment to engineering designers is also put forward.

AUTHOR: LI Xuotong

ORG: None

TITLE: "The Relationship between Ballistic Behavior and Structural Microdefects of T Propellant--An Application of SEM in the Study of Doublebase Propellant"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 3, Aug 81  
pp 60-67

TEXT OF ENGLISH ABSTRACT: The microstructure of a sampling propellant at different ballistic behaviors and under different manufacturing conditions is analyzed with a scanning electron microscope. The samples are taken from a homogeneous T propellant gelatinized by repellent solvent and shaped by thrusting. It is found that in the powder grain a lot of microdefects are unevenly but regularly distributed; the defects on the samples of normal and abnormal ballistic behavior are clearly different; the grains with good structure made under specific manufacturing conditions show normal ballistic behavior and structural changes caused by low temperature are observed. On the basis of analysis of the micropictures, the mechanism of inherent structural defects of abnormal ballistic behavior for T propellant is presented and critical technology which makes the ballistic behavior normal is analyzed.

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CSO: 4009/484

## Coal

AUTHOR: None

ORG: Combustion and Heat Transfer Engineering Teaching and Research Faculty

TITLE: "Experimental Investigation of Preparation and Handling of COM in Zhejiang University"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 25 Jun 81 pp 1-14

TEXT OF ENGLISH ABSTRACT: The experimental facilities of preparation, storage, handling and combustion system of COM in Zhejiang University are briefly introduced. Various properties of COM, with 10-69 percent coal powder concentration by weight, such as rheological and vaporization properties, isothermoflow and nonisothermoflow, field of temperature and velocity distribution in heating tube, sedimentation of coal particles, power consumption of propeller type mixer, homogeneity of COM preparation, heat exchange of COM with coil heater, under temperature variation ranging from 40 to 120°C, etc., were experimentally determined. The relationship of the apparent viscosity  $\mu_p$ , or the homogeneity factor  $k$  and the coefficient of rheological property  $n$  as a function of  $C_W$  and  $T$  may be written in the form of an exponential function. It has been found that COM is a kind of pseudoplastic fluid, its flow properties in most pipes consist of laminar flow and its pressure drop may be calculated by the laminar flow formula of pseudoplastic fluid with 7.85 percent standard error.

AUTHOR: None

ORG: Combustion and Heat Transfer Engineering Teaching and Research Faculty

TITLE: "Experimental Study of COM Combustion Process in the Tunnel Furnace"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 25 Jun 81 pp 15-33

TEXT OF ENGLISH ABSTRACT: In this paper, a description is given of the experimental tunnel furnace, equipped with the specially designed atomizing nozzle, which can run with good stability for a long time when burning COM with coal concentration as high as 40-50 percent. The combustion efficiency approached that of the furnace when burning heavy oil.

The dynamic properties of the combustion process, the rate of mass flow, the characteristics of its components, the heat flux and the emissivity of the COM flame along the axis of the tunnel furnace have been experimentally studied.

According to microscopic examination of the samples, it is found that the combustion of COM in the furnace has been carried out in the form of cenospheres with exit openings of different sizes. It is of no doubt that the combustion property of COM in the furnace is quite different from that of heavy oil droplets or that of coal particles.

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CSO: 4009/483

## Engineering

AUTHOR: ZHENG Zhaochang [6774 4453 2490]  
WU Jianji [0702 1696 1015]

ORG: Both of the Department of Engineering Mechanics

TITLE: "Dynamic Analysis of Vehicle Structures by Modal Synthesis Techniques"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 1-11

TEXT OF ENGLISH ABSTRACT: In this paper, the modal synthesis techniques are adopted for the vibration analysis of the whole vehicle structural system. The analysis procedure begins by subdividing the whole vehicle structural system into some component parts, substructures, such as body, chassis frame, wheels and axes, engine and attachment elements, such as body mounts, engine mounts and tires. For the elastic components, such as the chassis frame, the free-free natural frequencies and mode shapes can either be calculated by the finite element method or provided from experimental tests. The engine, wheels and axes may be taken as rigid bodies. These substructures are connected by attachment elements. All types of attachment elements are represented by linear elastic springs in the analysis. With the modal coordinates, after writing out the expression for the kinetic and potential energies of free-free substructures and springs, motion equations of the whole system can be obtained by Lagrange's equations. Only the spring forces are coupling terms of motion equations. All information of dynamic characteristics

[Continuation of QINGHUA DAXUE XUEBAO Vol 21 No 3, 1981 pp 1-11]

comes from separate analysis for each of the substructures. An approach emphasizing the clearness of physical concepts, mathematical simplicity, accuracy of results and for smaller computer capacity is thus presented. According to the final computer program, an example is given which shows advantages of the method.

AUTHOR: None

ORG: None

TITLE: "Success in Investigation of Hollow Cathode Discharge Ion-plating"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 p 12

ABSTRACT: The Nuclear Technology Research Institute of Qinghua University has successfully developed a HCD ion-plating apparatus. This technology has a wide application on measuring instruments, cutting tools, dies, etc., to increase surface resistance to corrosion and abrasion and extend working life. It has also proved valuable in the light industrial sector in plating wristwatch cases and bands, etc. A primary feature of this technology is that the metal thus plated is highly ionized.

AUTHOR: None

ORG: Scientific Research Group of Speech Recognition, Department of Computer Engineering and Science

TITLE: "The Application of a Microcomputer System for Speech Recognition"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 13-24

TEXT OF ENGLISH ABSTRACT: In this paper, the application of a microcomputer system for speech recognition is described. Original information is obtained from a digital dynamic spectral analyzer which gives the speech spectral data. The information is compressed either by a method called "blocking quartering" or by a two-dimensional Walsh transformation. Then the main information representing the features of the speech is extracted. This system must be trained at first to recognize the appointed words. An example of speech recognition by these two different methods is given as follows: (1) recognition of the names of 128 railway stations, including 78 stations on the Beijing-Guangzhou line and 50 stations on the Beijing-Mudanjiang line, by "blocking quartering;" (2) recognition of the names of 78 railway stations on the Beijing-Guangzhou line by two-dimensional Walsh transformation. The resulting identification accuracy of both methods reached approximately 97 percent.



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ORG: All of the Department of Radio and Electronics

TITLE: "A Study on Stimulated Raman Scattering in Doped Optical Fibers"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 25-33

TEXT OF ENGLISH ABSTRACT: This report is one of experimental investigations on multidegree stimulated Raman scattering spectrum in ordinary  $\text{GeO}_2$  fibers for optical communication. The comparison of the characteristics between the SRS spectra of  $\text{GeO}_2$  fiber and  $\text{P}_2\text{O}_5$  fiber has been demonstrated. The frequency shifts and relative intensity configuration of multidegree Stokes spectrum were measured and a simple analysis of spectrum characteristics using the concepts of effective scattering cross section and differences of vibrational energy levels was given. The purpose is to search for the possibility of a SRS fiber laser device with these two kinds of ordinary fibers.

AUTHOR: None

ORG: None

TITLE: "High Resolving Power Strippable Film Transfer Grids Type FG Win National Invention Prize"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 p 34

ABSTRACT: The dense grid moire method developed has wide applications in the determination of the strength and rigidity of engineering structures and machine components. It is also useful in the study of plastic deformation technology, material fracturing, etc. The FG grid has a resolution which equals or exceeds that of similar foreign products, giving clear borders and sharp black/white discrimination even at 500 lines/mm. It has been termed "outstanding" by American, West German and Japanese professionals.

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ORG: All of the Department of Mechanical Engineering

TITLE: "An Investigation of Formation and Propagation of Hydrogen Induced Cracks in High Strength Steel Testing Implant Using Acoustic Emission and Fractography"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 35-46

TEXT OF ENGLISH ABSTRACT: The initiation, propagation and rupture process of hydrogen induced cracks in high strength steel testing implant were studied by using acoustic emission. It was found that the initial position of delayed cracking in testing implant with circulat notch is regular. According to the wave form of acoustic emission, the process is divided into four stages: initiation, delayed crack propagation, rapid propagation and instantaneous rupture. The corresponding areas of these stages can be recognized on the fracture. The corresponding relationships between the stages and areas depend on stress, hydrogen and metallo-graphic structure.

In addition, the effects of hydrogen content, structure and properties of HAZ on the microappearance of fracture have also been studied.

AUTHOR: HAN Liying [7281 7787 3841]  
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TITLE: "Broad-band Multilayer Film with High Reflectance"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 47-58

TEXT OF ENGLISH ABSTRACT: This paper begins with the characteristic matrix of multilayer film of non-absorbing dielectric materials and the calculations of reflectance and transmittance of light for multilayer film is given. The band width of high reflectance of  $\lambda/4$  multilayer film is discussed. The method and technology of vacuum dissipation of broad-band multilayer mirror with high reflectance over an extended spectral region are described. The mirror is applied to the hollow cathode discharge He-Cd laser with multi-spectral line power output above 50 mw.

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PENG Shurong [1756 6615 2837]

ORG: JIN and HUANG both of the Department of Precision Instruments; PENG of the Tangshan Gear Plant

TITLE: "An Investigation of the Conventional HSS Cutting Performance by SOCNB Complex Permeation Treatment Method"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 21 No 3, 1981 pp 59-70

TEXT OF ENGLISH ABSTRACT: The good cutting performance of the conventional HSS ( $W_{18}Cr_4V$ ) cutting tool subjected to a new surface chemical heat treatment technique has been studied in this paper. The characteristic of this new technique is that through the process of complex permeation treatment many chemical elements, such as carbon, nitrogen, sulfur and oxygen, can be permeated into the surface layer of the cutting tool.

The results of this research show that the antifriction capability, wear and heat resistance of the layer of the treated cutting tool have been improved and, in general, the tool life can be stably increased by 100 to 200 percent.

AUTHOR: SHEN Tianyao [3088 1131 5069]

ORG: Department of Engineering Mechanics

TITLE: "Solution of the Problem of the Laminar Boundary Layer with Pressure Gradient in a Rotating System and Its Application in Impeller Design"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 21 No 3, 1981 pp 71-91

TEXT OF ENGLISH ABSTRACT: The first part of this paper deals with the application of Karman and Pohlhausen's method to the general problem of a two-dimensional laminar boundary layer with pressure gradient in a rotating system. It is a generalization of the approximate integration method for solving the problem of a two-dimensional laminar boundary layer with pressure gradient in a stationary system. But the generalized method could be applied to a rotating system. When the rotating speed is equal to 0, the results could be transformed to the original form given by H. Holstein and T. Bohlen.

In the second part of this paper, the boundary layer growth for three types of velocity distribution at the trailing side which are typical for centrifugal impeller blades is calculated, and the optimum velocity distribution is also discussed. The conclusion essentially agrees with the results given in a previous paper. The position of separation at the trailing side was calculated for blades of two

[Continuation of QINGHUA DAXUE XUEBAO Vol 21 No 3, 1981 pp 71-91]

different impellers and the results were compared with the measured values. The two experimental impellers were designed to satisfy the reverse transition criterion. The results of our method have been compared with the exact solutions of the laminar boundary layer problem on a rotating circular arc blade given by R.M. Hallen, J.P. Johnston and W.C. Reynolds. Our results are also compared with those given by G. Jungclaus concerning the solution of the boundary layer problem on a rotating flat-plate blade by using the Karman-Pohlhausen method.

AUTHOR: None

ORG: None

TITLE: "New Achievements in Development of the Key Task of Bucket Tooth Life on Bucket Wheel Excavator and DM-1 Dynamic Load Abrasive Wear Tester"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 21 No 3, 1981 p 92

ABSTRACT: (a) Qinghua University, in concert with the Hangzhou Heavy Machine Works, has developed a "durable cast steel alloy insert" which increases the tooth life of a bucket wheel excavator from 60 to more than 180 hours. Because the technology involved is simple, low-cost and long-lasting, it is estimated that its application nationwide could save tens of millions of yuan.

(b) The DM-1 Dynamic Load Abrasive Wear Tester was designed and developed by the Metals Teaching and Research Group, Qinghua University. The instrument utilizes a combination of mechanical and electrical testing; it can operate under varying loads, with different abrasives, at varying friction speeds; and its primary technical parameters have a relative error of <6 percent in one or multiple tests.

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TITLE: "Stresses and Displacements in Rotating Toroidal Shells"\*

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese  
Vol 21 No 3, 1981 pp 93-110

TEXT OF ENGLISH ABSTRACT: In this paper, Zhang Wei's asymptotic solution for Tölke's equation of axial symmetric toroidal shell in complex variable is extended to the second order solution, both for centrifugal and axial loads. A power series solution is also obtained. Both solutions are used in the calculation of C-type bellows. A comparison of calculated results shows close coincidence with each other for the whole range of  $\varphi$  except at the vicinity of  $\varphi = 0$ , while for small  $\varphi$  there exists a small difference between them.

\* This work has been carried out under the direction of Professor ZHANG Wei [1728 4850].

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CSO: 4009/1



## Geology

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TITLE: "Some Relationships between the Geological Structures and the Skarn-type Copper Deposits in the Tongling Area"

SOURCE: Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 27 No 4, 1981 pp 301-306

TEXT OF ENGLISH ABSTRACT: The Tongling area is a geodome in the diwa (geodepression) region in central China. The contact between the Mesozoic intermediate-acid intrusive magmatic rocks and the carbonate rocks in the proper tectonic layer of the platform resulted in abundant skarn-type copper ores. The mineralized horizons and the metallic mineralization types of the copper deposits appear to be controlled by the geological structures. The main manifestations are as follows:

1. The mineralized horizon of the deposits in the anticlines is lower than that in the syncline. The higher the anticline is uplifted, the lower the mineralized horizon will be; whereas the lower the syncline is depressed, the higher the mineralized horizon will be. In the same fold, the mineralized horizon is elevated with the plunging of the hinge. This reflects the connection between the mineralization depth and the paleostructure--erosion surface (during the mineralization) for this type of deposit.

2. The geological structures seem to control the zoning of the endogenic metallic

[Continuation of DIZHI LUNPING Vol 27 No 4, 1981 pp 301-306]

mineralization and the distribution of the mineralizing types. In the same ore field, the surface mineralization zoning is controlled by the plunging of the hinge of the fold. At places where the hinge of the fold is uplifted, the deep-level mineralization zone may be exposed due to more denudation, while at places where there has been little denudation along the plunging hinge only shallow-level mineralization zone is exposed. On a regional scale, the plunging end of an anticline controls the high-sulfur mineralization, which gradually grades to the high-oxygen type with the elevation of the hinge of the anticline. The compressive fault created a closed reducing environment, controlling the high-sulfur mineralization, whereas the tensional fault brought about an open oxidizing environment, controlling the high-oxygen mineralization. The mineral assemblages of various orebodies in the same ore deposit may also vary because of different mechanical properties of the ore-bearing structures. The ore mineral in the orebodies controlled by the compressor-shear fault is chalcopyrite, while those in the orebodies controlled by a tenso-shear fault are pyrite and bornite. The mineral assemblages in different sections of the same orebody may also differ because of different states of stresses.

AUTHOR: QIU Shiqiang [6726 0013 1730]

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TITLE: "A Preliminary Study of the Genesis of the Dabaoshan Stratiform Polymetallic Deposit"

SOURCE: Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 27 No 4, 1981 pp 333-340

TEXT OF ENGLISH ABSTRACT: This paper consists of three parts. Part 1 briefly describes the general geology of the mining area, the geological conditions for ore deposition (including ore-bearing strata, structure and magmatic activity) and basic characteristics of the deposit, and discusses the relationship between the geological conditions and the deposit. Part 2 is dedicated to the analysis of the sources of the ore-forming substances. The various geological grounds for the source of ore-forming substances of the deposit are discussed in five aspects (the tectonic cycle, the abundance of metallic elements in ore-bearing strata, the characteristics of sulfur isotopes and the intrusion of intermediate-acid rocks during the Yanshanian movement), which lead to the conclusion that there are multiple sources of ore-forming substance. The ore-forming substances were mainly derived from oldland (crust source) and submarine eruption (mantle source). Part 3 is a discussion of the metallogenic stages and the genesis of the deposit. In this paper the ore deposit-forming process is divided into four stages: sedimentation--

[Continuation of DIZHI LUNPING Vol 27 No 4, 1981 pp 333-340]

diagenesis--hydrothermal reformation--oxidation, and the following idea of the process is proposed: first the Devonian sedimentation resulted in the source bed, which was subsequently superimposed and reformed by hydrothermal solutions (enriched in W, Bi, Mo, Nb-Ta, Re, Cd, Ga, In, Se, Te and Tl) related to the Yanshanian intermediate-acid magmatic rocks, giving rise to the ore-forming substances to concentrate to ores. Fe (siderite), Cu, Pb, Zn, S and Mn ores were formed mainly by syngenetic sedimentation and secondarily by hydrothermal superimposition, while W, Bi, Mo, rare and dispersed element ores, are mainly of endogenic origin and secondarily of syngenetic sedimentary origin. So the stratiform polymetallic deposit in this area is genetically assigned to the "diagenetic" type.

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TITLE: "On the Characteristics and Genesis of the Hamubaizu Siderite Deposit"

SOURCE: Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 27 No 4, 1981 pp 341-348

TEXT OF ENGLISH ABSTRACT: This deposit is situated between the exploration lines A40 and A49 in the eastern Dahongshan Fe(Cu) ore field of Yunnan Province. Its length from east to west is over 900 m, and its width is about 400 m from south to north.

The deposit, generally with one to three ore beds, occurs in a series of sodium-rich volcanic-sedimentary metamorphic rocks called the Manganghe Formation in the Lower Proterozoic (?) Dahongshan Group. The country rocks are dolomitic marble intercalated with biotite albite schist. Since they are far away from the submarine volcanic center, the sedimentary environment and facies may be favorable for the formation of siderite.

The ores consist mostly of siderite, magnetite, chalcopryrite and pyrite. The gangue minerals are dolomite, albite, etc. Since siderite is rich in Mn and Mg, it is classified as manganese magnesian siderite. The ores possess a fine-medium

[Continuation of DIZHI LUNPING Vol 27 No 4, 1981 pp 341-348]

crystalloblastic texture and ribbon-formed, banded or massive structure.

In the metallogenetic zone, as a whole, the tuffaceous and argillaceous facies change gradually to the carbonate facies from west to east. In accordance, the ore type changes gradually from magnetite-chalcopryrite to the Cu-bearing siderite, so that the ore deposits gradually evolved from the magnetite-chalcopryrite type to the siderite one.

This siderite deposit is an essential member of the submarine volcanic metallogenic series in this region. Together with the Fe-Cu deposits, they all occur around an old volcanic center and appear to be controlled by the volcanic mechanism, volcanic cycle, lithological character, lithofacies and stratigraphical horizon during their formation. According to the geological setting of the deposit and the sulfur isotope values, it seems to belong to the volcanic exhalative sedimentary-metamorphic transformed origin.

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CSO: 4009/479

## Geophysics

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TITLE: "Observation of the Ionospheric Total Electron Content during the Solar Eclipse of 16 February 1980"

SOURCE: Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 24 No 3, 1981 pp 252-256

TEXT OF ENGLISH ABSTRACT: In this paper, results of the TEC measurement by 136 MHz beacon of ETS-II during the solar eclipse of 16 February 1980 at Heqing Station (100°12'E, 26°35'N) are discussed. The eclipse produces a premature sunset without any bite-out on the TEC curve during the course of the eclipse. However, it is indicated by the nonlinear relationship between TEC and  $N_B$  (the underlying electron content below  $F_2$ -layer peak) that  $N_B$  makes relatively smaller contribution to the measured Faraday rotation around the eclipse maximum. These results imply that for a near sunset eclipse, its dynamic effect on the ionosphere is very marked and its photochemical effect is restricted in the lower ionosphere. No gravity wave can be associated immediately with the eclipse, although quasi-periodic disturbances of very small amplitude can be seen on the residual curve of TEC after the running mean has been removed.

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TITLE: "The Behavior of  $F_2$  Layer above Ruili during the Solar Eclipse of 16 February 1980"

SOURCE: Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 24 No 3, 1981 pp 257-262

TEXT OF ENGLISH ABSTRACT: The morphology of the  $F_2$  layer during the solar eclipse is examined, and the mechanism of its formation is discussed theoretically. It is found that there are three different types of electronic density behavior in the  $F_2$  layer. Correspondingly, this layer can be divided into three regions according to the relative effects of photochemistry and dynamics. The authors consider that the thermal contraction of the ionospheric plasma produced by the change of the electronic temperature may be the principal cause of the morphological behavior of the  $F_2$  layer during this solar eclipse.



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TITLE: "Ionospheric E Region Instabilities Produced by Solar Eclipse"

SOURCE: Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 24  
No 3, 1981 pp 263-268

TEXT OF ENGLISH ABSTRACT: This paper gives the results of observation of the total solar eclipse of 16 February 1980, obtained by using a HF Doppler Sounder. In the period of the solar obscuration, three pronounced perturbations of the ionospheric E region were observed and, after the third contact, two perturbations were also observed. The main characteristics of the perturbations can be explained by the variations of the ionizing sources which were located in the solar active region. The highly correlated relations between the prompt variation of the solar active regions and the short-period perturbation of the ionospheric E region are shown. It is concluded that the prompt variation of the solar active regions is one of the important causes producing the ionospheric E region instabilities.

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TITLE: "Analysis of the Geomagnetic Effect during the 16 February 1980 Solar Eclipse in Yunnan Province"

SOURCE: Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 24  
No 3, 1981 pp 269-278

TEXT OF ENGLISH ABSTRACT: Three component (HDZ) normal and quick run (HD) records of the earth's magnetic field were made at Ruili, Yunnan Province, during the total solar eclipse of 16 February 1980. Daily variation, small disturbance and magnetic pulsation were analyzed. There was a change of  $-0.8' \pm 0.2'$  in D and  $-2.9 \pm 1.6\gamma$  in H. The amplitude ratio of small disturbances was decreased. These changes are consistent with the change in electron density in the E layer during the eclipse.



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TITLE: "On the Seismo-magnetic Induction Effect (II)"

SOURCE: Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 24 No 3, 1981 pp 296-309

TEXT OF ENGLISH ABSTRACT: The numerical theory of the three-dimensional electro-magnetic induction is a powerful tool in studying the seismo-magnetic induction effect, as well as the lateral inhomogeneity of the electrical structure in the earth's crust and upper mantle. The complete numerical equations were established in our previous paper. In this paper we first show both theoretically and numerically the uniqueness, convergency and stability of the solution of these equations under definite conditions. Then, some model calculations are carried out for various periods of source field and burying depths of local anomalous bodies to study the space-distribution and frequency characteristics of the seismomagnetic induction effect. Under the assumptions that the dimension of the anomalous body corresponds approximately to the source dimension of an earthquake of magnitude 5-7, and that its conductivity is 10 times as large as the normal value, the results

[Continuation of DIQIU WULI XUEBAO Vol 24 No 3, 1981 pp 296-309]

for a source period of a few seconds to a few minutes show that the largest anomaly, relative variation about 30 percent, of the horizontal component takes place in the central part above the anomalous body, and that the largest anomaly, relative variation 50 percent, of the vertical component takes place at the two sides perpendicular to the direction of the source field. Therefore, observing the anomalies of short period variations of the field might be a promising approach to monitoring conductivity variations associated with the earthquake process. The anomalous intensity of the seismo-magnetic effect, however, decreases quite rapidly with distance, so that the observing sites have to be near the earthquake source region, and this brings about the difficulty for their arrangement in advance.

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CSO: 4009/481

## Seismology

AUTHOR: CHENG Erlin [2052 1422 2651]

ORG: Seismological Bureau of Sichuan Province

TITLE: "Recent Tectonic Stress Field and Tectonic Movement of Sichuan Province and Its Vicinity"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese Vol 3 No 3, 1981 pp 231-241

TEXT OF ENGLISH ABSTRACT: This paper deals with the P-wave initial motion solutions of 76 earthquakes of magnitude greater than 5 which occurred in Sichuan Province during 1933-1978. It discusses the particular features of the recent stress field in each separate region and their relations to the recent tectonic movement of the neighboring regions and to plate tectonic theory. In combination with the results of geological and seismological field observations, the character of recent tectonic movement of the principal fracture systems of Sichuan Province has also been discussed. Finally it is pointed out that, if we assume a rotation of the Tibet-Qinghai-Sichuan block from SEE toward SE to SSE, the principal features of the recent tectonic stress and tectonic movement of Sichuan Province, or even all of western China, can be explained.

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TITLE: "Time and Space Scanning of Parameters of Seismicity over a Broad Region Before Strong Earthquakes"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese Vol 3 No 3, 1981 pp 283-291

TEXT OF ENGLISH ABSTRACT: Before strong earthquakes, certain anomalous features may show up in the seismicity of a broad region, possibly caused by the concentration of stress and the ensuing anelastic deformation at the source region of the earthquakes. Certain parameters of seismicity with rather obvious physical meanings and supported by the results of rock fracture experiments are selected for the study, namely the areal extent  $A$  of the seismic active area, seismic energy released  $E$ , accumulative numbers  $\Sigma N$  of earthquakes and the value  $b$  of large and small earthquakes, etc. A method of scanning has been adopted to first search for the dangerous location under which a strong earthquake is in the process of development and then apply time scanning to show further the transition from medium to medium-short range of anomalous features of seismic activity before the occurrence of a large earthquake.

[Continuation of DIZHEN XUEBAO Vol 3 No 3, 1981 pp 283-291]

Based on scanning of the observed seismicity data of north China, southwest China and northeast China before several large earthquakes, emphasis has been laid on the anomalous seismic feature of north China before the 1976 Tangshan earthquake of magnitude 7.8. The paper also discusses the different roles played by the parameters of seismicity in medium-term prediction of strong earthquakes. It is believed that such a method of time and space scanning, particularly of the b value, has certain significance in medium-term earthquake prediction.

AUTHOR: None

ORG: None

TITLE: "Committee on Earthquake Engineering Formed Under the Chinese Seismological Society"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese Vol 3 No 3, 1981 pp 331-334

TEXT OF ENGLISH ABSTRACT: On 23 March 1981, a committee on earthquake engineering was organized under the Chinese Seismological Society. Professor Liu Huixian has been elected as the chairman of the committee.

The Chinese Seismological Society announced this new organization at a scientific meeting held in Nanjing. More than 80 scientists, engineers and leading members from research institutes and universities attended the meeting. About 50 papers were read at the symposiums.

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CSO: 4009/480

## Seismology and Geology

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TITLE: "The Metamorphism and Genetic Problems of Eclogites from Hongtushan and Qinglongshan Mountains of the Donghai Region, Jiangsu Province"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81  
pp 17-30

TEXT OF ENGLISH ABSTRACT: This paper deals with the mineralogical and petrological features of eclogites from Hongtushan and Qinglongshan mountains of the Donghai Region, Jiangsu Province. According to the experimental results of related rocks, the genetic condition of eclogites can be estimated as  $T=890-1275^{\circ}\text{C}$  and  $P=17.25-24.75\text{ kb}$ , at a depth of 50-70 km. From the petrochemical characteristics, the parent rock of eclogites can be considered as tholeiitic basalt. It can be assumed that the evolutionary of eclogites in the studied region started with the metamorphism of tholeiitic basalt into basic granulite, and then the basic granulite further turned into eclogite due to the dynamic process of progressive metamorphism. This process can be expressed by means of  $0.61\text{ hypersthene} + \text{plagioclase (An=61)} = \text{Omphacite (Jd=39)} + 0.61\text{ kyanite} + \text{quartz}$ . Finally, the eclogites accompanied by the faulting intruded into the supracrustal migmatitic gneisses. In this process

[Continuation of DIZHEN DIZHI No 3, Sep 81 pp 17-30]

the temperature decreased from  $1080^{\circ}\text{C} \pm 190^{\circ}\text{C}$  to  $750^{\circ}\text{C} \pm 80^{\circ}\text{C}$ , and the pressure from  $21.0\text{ kb} \pm 3.75\text{ kb}$  to  $4.0\text{ kb} \pm 2.5\text{ kb}$ . It follows that the sequent retrogressive metamorphism of eclogites was caused by the dynamic effect of faulting. The conditional formula of this dynamic metamorphism can be approximately expressed as  $P(\text{kb}) = 0.0506T(^{\circ}\text{C}) - 33.65$ .

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TITLE: "Division and Correlation of the Late Quaternary Stratigraphy and Discussion on the Recent Tectonic Movement in the Region of the Luanhe River Delta"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81  
pp 31-36

TEXT OF ENGLISH ABSTRACT: Based on the field investigations and  $C^{14}$  datings of 25 specimens, the problems with the division and correlation of the Late Quaternary stratigraphy and the recent tectonic movement in the region of the Luanhe River delta are discussed. The studies indicate that the three incised alluvial fans of the Luanhe River were formed during about 18,000, 11,000 and 6,000-3,000 years BP, respectively. In the northern coast of the Bohai Bay, there was a transgression during the Middle Holocene. The ages of three ancient coastlines are of about 5500, 3700 and 350 years respectively. The largest subsidence amplitude is of about 10 m (Jiנגgezhuang). Due to the difference in subsidence rate of the east and west parts of the newest delta of the Luanhe River, the course of the Luanhe River continuously migrated eastward since the Middle Holocene.

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ORG: Department of Geophysics, Beijing University

TITLE: "Earthquake Faulting and Stress Field"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81  
pp 37-46

TEXT OF ENGLISH ABSTRACT: The relationship between the earthquake faulting and tectonic stress was considered in this paper. The results of the earthquake mechanism were reviewed. It shows that the fault plane obtained from the fault plane solution agrees well with the surface break caused by the earthquakes, but the fault plane solution does not give a good explanation for the orientation of stress. In addition, an earthquake may be a complex rupture process and the onset of  $p$  waves just reflects the initial state of this process.

The Coulomb criterion for rock failure was applied to investigate the earthquake faulting. It shows that the angle between the faulting plane and the greatest principal stress is less than or equal to  $\pi/4$  in the homogeneous and isotropic materials, and the result obtained from the fault plane solution can be regarded as a special case for them with  $\mu = 0$ , i.e., no friction exists. When the material contains preexisting faults or weakened zones, the angle may be distributed in a



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wide range. It depends on the fracture parameters of the material, such as  $S_0$ ,  $S_w$ ,  $\mu$ ,  $\mu_w$ , as well as the intermediate principal stress. Five basic processes of the stress changes which may cause earthquakes are discussed in this paper.

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TITLE: "A Preliminary Study of the Free Air Gravity Field in the Chinese Continent"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81 pp 47-60

TEXT OF ENGLISH ABSTRACT: Based on the measured ground data, 10 free air gravity maps of China have been constructed from mean free air values in square areas of  $1^\circ \times 1^\circ$  to  $10^\circ \times 10^\circ$  using an average filter to eliminate successively the shorter wavelengths. These results indicate a great difference between east China and west China in the anomaly configuration: the anomaly value changes are gentle in the east and sharp in the west; the short wavelength anomalies trend in a NE direction in the east and NW in the west, whereas the long wavelength anomalies trend in a NS direction in the east and EW in the west. In addition, there are four NW disturbance zones cutting across the NE linear anomalies in the east. From map 1 ( $1^\circ \times 1^\circ$ ), it can be seen that in the east there exist two prominent nearly parallel positive anomaly zones, one of which extends from the Changbaishan mountains through

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the Liaoning and Shandong peninsulas into the coastal ranges in Zhejiang and Fujian provinces, and the other runs from the Dahingganling mountains along the Taihangshan mountains through the Qinling mountains into the ranges of western Hubei and Hunan provinces. Between the two zones exists a wide and low gravity anomaly zone associated with the Songliao, North China and Jiangnan plains and Hengyang basin. In the west, the anomaly configurations are very complex and have the same NW direction as the positive linear anomalies over the Qilianshan mountains, the eastern Tianshan and the Altayshan. On map 2 ( $3^{\circ} \times 3^{\circ}$ ) are shown the high-amplitude positive anomalies for almost all the mountain regions and the low-amplitude positive or negative anomalies for all the plains and plateaus, whereas the interior basins always correspond to the large high-amplitude negative anomalies. On map 3 ( $5^{\circ} \times 5^{\circ}$ ) can be found five dominant large anomalies for the Chinese continent: the positive from  $110^{\circ}\text{E}$  to the east, the negative over the Sichuan basin and Ordos plateau, the positive over the Qinghai and Xizang region, the negative over the Nei Monggol and Xinjiang Autonomous Regions. In addition, a great negative anomaly appears in eastern Xizang. As shown on maps 4 and 5 ( $7^{\circ} \times 7^{\circ}$  and  $9^{\circ} \times 9^{\circ}$ ), the direction of the main linear anomalies turns into a normal NS one in east China and EW in the west. It is suggested that the short wavelength anomalies ( $1^{\circ} \times 1^{\circ}$ ) associated with the tectonic features are produced due to successive tectonic movements causing the nonhomogeneous mass distribution in the lithosphere. The moderate wavelength anomalies ( $3^{\circ} \times 3^{\circ}$  and  $5^{\circ} \times 5^{\circ}$ ) resulted from the broad bent of the lithosphere caused by the current stress from plate motions. Probably the long

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wavelength anomalies ( $7^{\circ} \times 7^{\circ}$  and  $9^{\circ} \times 9^{\circ}$ ) are related to the mantle deep-seated mass inhomogeneity, except the effect of the plate motions. The relation of the above-stated phenomena to the tectonic framework, isostasy and seismicity as well as the possible geodynamical process are also discussed.

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TITLE: "The Relation Between the Reservoir Induced Earthquakes and Geologic Structures"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81  
pp 61-69

TEXT OF ENGLISH ABSTRACT: There are many cases showing that reservoir induced earthquakes have a very close relationship with geologic structures. This paper discusses the relationship of reservoir induced earthquakes with the intensively active geotectonic area, the fractured zone and differential movement among blocks in the light of data obtained in practical work.

As is well known, reservoir induced earthquakes are closely related to geotectonic conditions. Usually this kind of shock occurs in strongly active geotectonic areas, such as the Cenozoic geosynclinal folding zone and Diwa region, especially in the arcuate inflection points of an active fault or at the intersection of several groups of structural lines where the neotectonic differential movement was evidently caused. By means of triangulation and leveling it is suggested that the reservoir induced earthquakes also occurred at the tectonic junction of blocks (horst and graben) which are tectonically active to a certain extent at present. Moreover, it is a portion in which the stress, particularly the tensile or shearing stress, is easily concentrated.

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TITLE: "Mathematico-statistical Prediction of Liquefaction of Soil during an Earthquake"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese No 3, Sep 81  
pp 71-82

TEXT OF ENGLISH ABSTRACT: The 1976 Tangshan earthquake ( $M=7.8$ ) caused extensive soil liquefaction in the broad Beijing-Tianjin-Tangshan plain region, resulting in severe damage. For this reason we have to estimate whether the liquefaction could happen during future shocks, which would be an important basis on which to propose measures of reduction of seismic hazards. As is well known, the engineering construction is in urgent need of the comprehensive prediction of liquefaction. Usually the conventional geological or experimental methods could only give predictable indicates in the cases of simple and fewer factors. This paper statistically predicts soil liquefaction based on the measured and tested data during the engineering exploration.

Using the method of stepwise discrimination analysis of Bayes' criterion, 13 and 15 variances selected from the liquidated and unliquidated localities can be used as

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correlation calculations in five ways. The variance pattern with the highest accuracy and confidence is chosen to predict the liquefaction at a location of level VIII in intensity. The five kinds of prediction are in close agreement and can prove each other. In addition, the maximum probability posterior of grouped samples is mostly above 0.99, with high confidence. In such a case, the extrapolated results are reliable.

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